

An overview of NCMRWF model guidance for 12th Indian Scientific Expedition to the Southern Ocean

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Customised real-time model guidance from the seamless prediction system of the National Centre for Medium Range Weather Forecasting (NCMRWF) supported the 12th Indian Scientific Expedition to the Southern Ocean (ISESO12). Atmospheric model guidance was prepared from the NCMRWF Global (NCUM-G) model forecast. The NCMRWF Coupled (C-NCUM) global model was used to prepare ocean and sea ice products. Daily model guidance of atmospheric and ocean variables from model analysis and forecast for the next five days with 24-hour interval, was delivered to IES012 science team. The wind speed, maximum air temperature, minimum air temperature and rainfall from the automatic weather station of the research vessel were compared with model guidance. Model forecasted air temperature was found to be in good agreement even with five day lead forecast. Wind speed was slightly underestimated with a better reliability of model guidance. Whereas, the rainfall estimates were found to be challenging and less accurate from the model guidance. However, the situational awareness support was found to be critical in informed decision-making for the safe and efficient accomplishment of the scientific objectives of IES012.

Sciences, Government of India, initiated Indian Scientific Expeditions to the Southern Ocean (ISESO) in 2004, led by the National Centre for Polar and Ocean Research, Goa. Several scientific expeditions were then carried out with defined scientific objectives focused on the underexplored regions of ISS0^{4,5}.

The situational awareness support system can aid in the effective planning of research activities to maximise data collection. It allows for dynamic rerouting from the pre-planned cruise track – either to avoid severe weather conditions in the interest of vessel safety or to better align with prioritised scientific objectives. Daily assessments of five-day weather forecasts by the onboard science team help identify potential anomalous weather systems in advance. This enables timely preparation, including the securing of instruments within the laboratory and on the ship's deck. Such informed decision-making enhances preparedness and supports operational safety and data integrity, benefiting the scientific team and the ship's crew. Research expeditions to more dynamic and challenging regions with the presence of sea ice and real-time satellite products are found to be very practical and helpful in critical situations. Several Earth-Observation data products were used by the Space Applications Centre, Ahmedabad, to issue sea ice advisories during Indian scientific expeditions to Antarctica⁶. A study by Mishra *et al.*⁷ proposes an algorithm to optimise the ship navigation route and found to be very effective based on a case study of the 33rd Indian Scientific Expedition to Antarctica (ISEA33) route. There have been efforts to utilise satellite products for sea ice navigation for the Indian Ocean sector of the South-

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